

Claims

1. An arrangement for saving energy in a radio device transmitter, radio frequency amplifiers of which being at least a VGA and a power amplifier, which VGA comprises at least one main differential pair, total current of which being arranged
5 to be dependent on input signal of the VGA and a collector current of one transistor of the main differential pair being output signal of the VGA, the VGA further comprising a control circuit to change mutual steering of transistors in the main differential pair so that VGA's current gain changes corresponding to changes in a gain control signal, the arrangement comprising in the VGA a bias current source
10 controllable by said gain control signal, output of which bias current source being connected to said power amplifier to make a steady current of the power amplifier dependent on the current gain and thus transmitting power,
wherein;
said bias current source comprises a bias differential pair, the bases of the transistors of which are connected parallel to the bases of the transistors of the main differential pair for steering these pairs by one and the same control signal, and a current of said output of the bias current source is arranged to track in proportion
15 collector current of the transistor of the bias current source, the base of which is parallel with the base of said one transistor of the main differential pair.
- 20 2. The arrangement according to claim 1, the bias differential pair and the main differential pair being located on one and the same substrate to equalize the electric characteristics of these pairs.
3. The arrangement according to claim 1, output current of the bias current source being arranged to track in proportion the collector current of the transistor
25 of the bias differential pair by means of a current mirror circuit, a transistor of which is load of said transistor of the bias differential pair and a current of another transistor of the current mirror circuit is output current of the bias current source.
4. The arrangement according to claim 1, the steady current of the power amplifier being arranged to track in proportion the output current of the bias current
30 source by means of a second current mirror circuit, a transistor of which is load of said output of the bias current source and a current of another transistor of the second current mirror circuit is the steady current of the power amplifier.
5. The arrangement according to claim 4, said second current mirror being asymmetric so that the output current of the bias current source is substantially

lower than the steady current of the power amplifier to reduce the own losses of the bias current source.

6. The arrangement according to claim 1, the radio device transmitter further comprising a driver amplifier for said power amplifier, wherein;

5 the bias current source further has a second output, a current of which is arranged to track in proportion the collector current of the transistor of the bias differential pair, the base of which is parallel with the base of said one transistor of the main differential pair, which second output is connected to said driver amplifier to make a steady current of the driver amplifier dependent on the current gain and thus
10 transmitting power.

7. The arrangement according to claim 1, the control circuit of the VGA having a differential output, wherein;

the VGA comprises first and second main differential pairs being parallel such that the bases of first transistors of these pairs are connected to first terminal of the
15 differential output of the control circuit and the bases of second transistors of these pairs are connected to second terminal of the differential output of the control circuit, and said input signal is arranged to be fed to a third differential pair, the collector of first transistor of the third pair being connected to the emitters of the transistors of the first pair and the collector of second transistor of the third pair being
20 connected to the emitters of the transistors of the second pair.

8. A radio device having an arrangement for saving energy in it's transmitter, radio frequency amplifiers of which being at least a VGA and a power amplifier, which VGA comprises at least one main differential pair, total current of which being arranged to be dependent on input signal of the VGA and a collector current of
25 one transistor of which being output signal of the VGA, the VGA further comprising a control circuit to change mutual steering of transistors in the main differential pair so that VGA's current gain changes corresponding to changes in gain control signal, the arrangement comprising in the VGA a bias current source controllable by said gain control signal, output of which bias current source being connected to
30 said power amplifier to make a steady current of the power amplifier dependent on the current gain and thus transmitting power, wherein;

said bias current source comprises a bias differential pair, the bases of the transistors of which are connected parallel to the bases of the transistors of the main differential pair for steering these pairs by one and the same control signal, and a
35 current of said output of the bias current source is arranged to track in proportion

collector current of the transistor of the bias differential pair, the base of which is parallel with the base of said one transistor of the main differential pair.